THE anhydrous sulphates of zinc, copper, nickel, and cobalt have been obtained in well-developed crystals by M. Klobb, who describes his experiments in the current number of the *Comptes rendus*. It was first observed that when a small quantity of the ordinary hydrated sulphate of cobalt was allowed to fall into fused sulphate of ammonia it immediately dissolved, imparting a deep blue colour to the liquid, and when the heating was continued in such a manner that the ammonium sulphate slowly volatilized away, the walls of the crucible were found to be covered with small red crystals. Upon analysis these crystals proved to be those of anhydrous cobalt sulphate. Similar experiments with the hydrated sulphates of zinc, copper, and nickel succeeded equally well, and it was found to be immaterial whether the hydrated salts with five, six, or seven molecules of water, or the amorphous anhydrous salts obtained by ignition, were employed. The best mode of operating in order to obtain good crystals is briefly as follows. A quantity of ammonium sulphate is placed in an ordinary porcelain crucible; over this is then laid an intimate mixture of ammonium sulphate with one-third its weight of the metallic sulphate required. The crucible, covered by its lid, is then inclosed together with a packing of sand within a Hessian crucible, which is afterwards placed in a muffle furnace and heated until the sulphate of ammonia has all escaped. The heating should then be at once discontinued in order to prevent decomposition of the metallic sulphate. After cooling, if the heating has been carefully conducted, the residual metallic sulphate is found to be crystalline throughout, and to consist largely of single well-formed crystals. The result is particularly good in the case of zinc sulphate. If quantities of about twenty grams of anhydrous zinc sulphate are employed, colourless octahedrons two and a half millimetres long may be obtained. These crystals only dissolve with extreme slowness in cold water, but are much more rapidly dissolved upon warming. Sulphate of copper treated in a similar manner yields prismatic needles of the anhydrous salt. These crystals present a pale grey appearance, but on being left exposed to the air for a few days they assume first a green tint and subsequently pass over to the ordinary pentahydrated blue salt. Unlike the crystals of anhydrous zinc sulphate, they are rapidly dissolved by cold water, forming the usual blue solution. The crystals of anhydrous sulphate of cobalt prepared in like manner consist of brilliant red octahedrons, which are apparently unaltered by exposure to the air, and which are only slightly attacked by water even when boiling. Still more remarkable are the green crystals of anhydrous nickel sulphate obtained by the above mode of preparation, for these crystals, so unlike the readily soluble hydrated sulphate, are practically insoluble both in cold and boiling water. This last instance affords a striking example of the influence of water of crystallization upon the solubility of a salt.

THE additions to the Zoological Society's Gardens during the past week include an Entellus Monkey (*Semnopithecus entellus* ♂) from India, presented by Dr. Wm. Eames and Dr. Earle, R.N.; a —— Owl (*Pseudoscops grammicus*) from Jamaica, presented by the Trustees of the Jamaica Institute; a Green Conure (*Conurus pavua*) from Trinidad, presented by Mrs. Hill; two Sharp-nosed Crocodiles (*Crocodilus acutus*) from Central America, presented by Sir Henry Arthur Blake, K.C.M.G.; two Common Vipers (*Vipera berus*), British, presented by Mr. A. Cotton, F.Z.S; an Orange-winged Amazon (*Chrysotis amazonica*); two Mississippi Alligators (*Alligator mississippiensis*) from South America, a Mantchurian Crossoptilon (*Crossoptilon mantchuricum*) from Northern China, four Spiny-tailed Mastigures (*Uromastix acanthinurus*) from North Africa, deposited; a Slow Loris (*Nycticebus tardigradus*) from Borneo, two Bar-breasted Finches (*Munia nisoria*) from Java, two Mute Swans (*Cygnus olor*), European, purchased; an Angora Goat (*Capra hircus* var.), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF THE SPECTRUM OF NOVA AURIGÆ.—Dr. Henry Crew, in *Astronomy and Astro-Physics* for March, gives a general description of the visible spectrum of Nova Aurigæ on February 10 and 11, observed by him with a spectroscope attached to the 36-inch of the Lick Observatory. The positions of the following lines were determined by direct comparison with the lunar spectrum and the spark spectra of hydrogen and magnesium:—

No. of line.	Wave-length.	Description.
1	6565·8	Probably C; very broad and bright in prism; not seen in grating.
2	6321	Faint, broad, diffuse.
3	6209	Not quite so bright as 2, but broader; both 2 and 3 may be bright only in comparison with neighbouring absorption bands.
4	5898	Yellow line, just below D.
5	5265	Three very faint lines; difficult to say whether they are really bright lines or simply bright regions bounded by dark spaces.
6	5254	
7	5216	
8	5167·1	Much more brilliant than any of the preceding; quite broad; much sharper on the upper side than the lower; nearly coincides with b_4. The most brilliant part of the continuous spectrum is terminated abruptly by this line.
9	5009	Of about the same brilliancy as 8, and, like it, sharper on the upper side.
10	4920	About half as bright as 9.
11	4861·6	Probably F; not less than 6 tenth-metres in width.
12	4352	Hγ? Wide and difficult to see.

A curve, showing the intensities of the lines as seen with a prism, accompanies this description. Prof. Young has determined the positions of twelve bright lines in the Nova spectrum (*Astronomical Journal*, No. 258). The wave-lengths are as follow: 4340 (Hγ), 449, 4861 (F), 4922, 5015, 5165, 5260, 5304, 559, 590 (D ?), 632, 6563 (C). A faint line was also glimpsed below C, and another—probably *h*—above G. The lines at 4922 and 5015 are believed not to be nebular lines. Those at 559 and 632 are possibly coincident with the two principal lines in the aurora spectrum.

DENNING'S COMET (*b* 1892).—*Edinburgh Circular* No. 25 contains the following elements and ephemeris of Denning's comet, computed by Dr. R. Schorr:—

Elements.

T = 1892 May 6·13922 Berlin M.T.

π − ☊ = 126° 39′ 17″·7
☊ = 252 55 13·8
i = 89 49 45·1
log q = 0·298920

Ephemeris for Berlin Midnight.

1892.	R.A. h. m. s.	Decl. ° ′	Log r.	Log Δ.	Brightness.
April 15	1 29 2	+59 47·0	0·3024	0·3989	0·95
,, 19	1 49 52	59 11·4	0·3012	0·4041	0·93
,, 23	2 9 26	58 29·1	0·3002	0·4095	0·91
,, 27	2 27 43	57 41·4	0·2995	0·4149	0·89
May 1	2 44 45	56 49·5	0·2991	0·4204	0·87
,, 5	3 0 37	55 54·2	0·2989	0·4258	0·85
,, 9	3 15 23	54 56·6	0·2990	0·4311	0·83
,, 13	3 29 7	53 57·3	0·2994	0·4362	0·81
,, 17	3 41 55	52 56·7	0·3000	0·4411	0·79
,, 21	3 53 52	51 55·4	0·3008	0·4458	0·77
,, 25	4 5 3	50 53·8	0·3020	0·4502	0·75
,, 29	4 15 32	+49 52·0	0·3034	0·4543	0·72

The brightness at the time of discovery is taken as unity.

The comet passed about half a degree north of γ Cassiopeiæ on April 8, and is moving towards Perseus.

COMET SWIFT, 1892.—The following are places for this week for 12h. Berlin mean time:—

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1892.	R.A. h. m. s.	Decl. °
April 16	21 44 50	+8 21·2
,, 17	21 48 13	9 16·5
,, 18	21 51 35	10 11·1
,, 19	21 54 55	11 4·9
,, 20	21 58 13	11 57·8
,, 21	22 1 30	12 49·9
,, 22	22 4 45	13 41·2
,, 23	22 7 59	14 31·6

Displacement of Radiant Points.—The late Dr. J. Kleiber left behind him a paper "On the Displacement of the Apparent Radiant Points of Meteor Showers due to the Attraction, Rotation, and Orbital Motion of the Earth." The paper appears in the March number of *Monthly Notices of the R.A.S.* The three principal causes of displacement mentioned in the title are treated separately, and the theory is illustrated by a consideration of the Perseid and Andromedid radiants. More than twenty years ago Schiaparelli developed formulæ for determining the amount of displacement of a radiant point due to the attraction of the earth. The effect of the attraction is to diminish the zenith-distance of every radiant and leave its azimuth unchanged. The corrections to be applied to the co-ordinates of the Perseid and Andromedid radiants on account of this disturbing cause were computed by Dr. Kleiber, and are given in his paper. It is shown that the latter swarm affords a good example of the displacement of a radiant due to the attraction of our planet. The rotation of the earth produces a small aberration of radiants, never amounting to more than 1° in the latitude of Greenwich. With regard to the earth's orbital motion, Dr. Kleiber found that it is sufficient to explain the displacement of 57° in right ascension, and 10° in declination, observed by Mr. Denning in the case of the Perseid swarm. And, after the proper corrections have been applied, it appears that of the forty-nine radiants catalogued by Mr. Denning as belonging to the Perseid shower, "forty-six lie within a circle described about the cometary radiant with a radius of 2°." This important result settles definitely the question as to the reality of the shift of radiant points.

Two New Variables in Cepheus.—Mr. Paul S. Yendell, in the *Astronomical Journal*, No. 258, communicates the discovery of two variables of long period in Cepheus. One of them, D.M. 50° 2769, has a range of variation of a full magnitude (5·8 mag. to 6·8 mag.) in about a year. An interesting point is that "the star is apparently subject, especially near its maxima, to sudden and considerable fluctuations in light, often amounting to several steps from one night to the next." The star No. 8594 of Chandler's "List of Stars probably Variable" has been proved to be variable. The period is about 348 days, and the light-range about 0·7 mag., from 6·2 mag. to 6·9 mag.

On the Variation in Latitude.—At the Paris Academy on March 28, M. Faye said:—"The question of the variability of latitudes has lately occupied the minds of astronomers and geodetists to a large extent. The Academy will hear with interest that this question appears to be settled in the affirmative by some observations that the Geodetical Association has recently had made at Honolulu. Whilst at Berlin, Prague, and Strasburg, the latitude increased 0″·04 from June to September, and afterwards decreased 0″·1 or 0″·2 to December, and then diminished 0″·13 to January, at Honolulu it varied in the opposite direction—that is, it fell about 0″·3 from June to September, and increased 0″·13 from December to January."

THE INSTITUTION OF NAVAL ARCHITECTS.

The annual spring meeting of the Institution of Naval Architects was held on Wednesday, Thursday, and Friday of last week, the President, the Earl of Ravensworth, occupying the chair during the whole of the sittings excepting that of Thursday evening, when Admiral Sir John Hay presided. The programme was not quite so long as usual, the Council of the Institution having come to the conclusion—wisely, we think—that it would be more desirable to have fewer papers and devote more time to their respective consideration. As it is now settled that the Institution is always to hold two meetings in the year, there is a chance of relief to what was always a congested programme when the business of the whole year was crowded into a single session. Where the summer meeting is to be held this year is not yet settled, but it is to be hoped that some place in the provinces will be selected, as it is right that the great shipbuilding centres of the Kingdom, of which London is not one, should be visited by the leading shipbuilding institution.

The following is a list of the papers read, in the order in which they were taken:—On divisional water-tight bulkheads as applied to steamers and sailing-vessels, by B. Martell, Chief Surveyor Lloyd's Register of Shipping; on steadying vessels at sea, by J. I. Thornycroft; notes on some recent experiences with H.M. ships, by W. H. White, C.B., F.R.S.; a ram vessel and the importance of rams in war, by Commander E. B. Boyle, R.N.; whale-back steamers, by F. C. Goodall; on an approximate rule for the vertical position of the centre of buoyancy, by S. W. F. Morrish; on balancing marine engines and the vibration of vessels, by A. F. Yarrow; some notes on the strength of steamers, by A. Denny; on the transverse stability of ships, and a rapid method of determining it, by W. Hök; notes on experiments with inflammable and explosive atmospheres of petroleum vapour, by J. H. Heck; on the theoretical effect of the race rotation on screw propeller efficiency, by R. E. Froude; performance of three sets of engines belonging to the second-class cruisers recently added to H.M. Navy, as calculated from the full-power steam trials, by Mr. J. G. Liversidge, R.N.

It is evident that the space at our command will not permit us to give anything approaching a full description of a meeting that occupied five sittings, some of them of over four hours' duration; and we will therefore concentrate our attention upon those points more especially within our scope. Mr. Martell's paper was one of great value, but it was treated from a purely constructive point of view. There are, it may be remarked in passing, some very nice mathematical and physical considerations involved in the study of the theory of bulkheads. This was pointed out by Dr. Elgar during the discussion, but up to the present we are not aware that the matter has been approached in a philosophic spirit. Before that can be done, certain experimental data must be obtained, and it will then remain for the mathematician to apply the canons of his science to the elucidation of the problems involved.

Mr. Thornycroft's paper on the steadying of vessels at sea was an account of some investigations and experiments carried out by one of our most scientific and careful mechanical engineers. Mr. Thornycroft has a steam-yacht, the *Cecile*, of 230 tons displacement. With this vessel he proceeded to make experiments with a view to reducing the rolling motion in a sea-way. The *Cecile*, it should be stated, is a bad roller, or, rather, a difficult vessel to prevent from rolling, as she has large metacentric height and a flat floor; in other words, she has considerable stability. In this vessel Mr. Thornycroft fitted, under the cabin floor, a shaft, which was free to turn completely round its axis, and to this was keyed a mass of ballast weighing 8 tons. The shaft had a crank, which was actuated by an hydraulic motor. In this way the ballast could be moved out from the centre line of the ship, so as to counteract the rolling motion. The movement of the weight had naturally to be provided for by some automatic arrangement, and this was supplied by a short-period pendulum placed near the centre of gravity of the ship, and actuating the valves of the motor. So far, all is simple enough, but here the difficulties commence. The inertia of the heavy mass of ballast will cause some loss of time, as only a limited force could be used for its control, and Mr. Thornycroft sets himself the task of overcoming this difficulty. He therefore introduced a second pendulum, of long period, which tends to move the ballast in an opposite direction to the first pendulum, and this enables the apparatus to discriminate between the angular motion of the water and that of the vessel. Mr. Thornycroft found, however, that the long-period pendulum is rather a delicate instrument, and its function can best be served by a cataract arranged to always slowly return the ballast to the centre. This device has the effect of accelerating the phase of motion, which in some cases is required. Unfortunately, at this point Mr. Thornycroft's description breaks off. The mechanism by which the motion of the pendulum is made to govern the movement of the weight was described by Mr. Beauchamp Tower, who has seen it in operation, as "the greatest intellectual treat to all who appreciated the niceties of mechanical design." This intellectual treat was denied to the members of the Institution, for the mechanism was not described further than that it was an electrical device. Those, however, who have attempted to work with pendulums on board

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